United Nations

# Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

## General Assembly

**Official Records**
**Fifty-sixth session**
**Supplement No. 46 (A/56/46)**

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# Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

United Nations • New York, 2001

*Note*

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ISSN 0255-1373

[Original: English]
[27 April 2001]

1. During the past few years, the United Nations Scientific Committee on the Effects of Atomic Radiation[1] has undertaken broad reviews of the sources and effects of ionizing radiation. Estimates of the carcinogenic risk from exposures to ionizing radiation were presented in its 2000 report.[2] In its 2001 report, the Committee has completed a comprehensive review of the risks to offspring (hereditary risks) following parental exposure to radiation. For the first time, the review included an evaluation of those diseases which have both hereditary and environmental components, the so-called multifactorial diseases. The major finding is that the total hereditary risk is 0.3-0.5 per cent per gray to the first generation following radiation. This is less than one tenth of the risk of fatal carcinogenesis following irradiation presented in the 2000 report.

2. The present report and its scientific annex were prepared between the forty-fourth and fiftieth sessions of the Committee. The following members of the Committee served as Chairman, Vice-Chairman and Rapporteur, respectively, at those sessions: forty-fourth and forty-fifth sessions: L. Pinillos-Ashton (Peru), A. Kaul (Germany) and G. Bengtsson (Sweden); forty-sixth and forty-seventh sessions: A. Kaul (Germany), L.-E. Holm (Sweden) and J. Lipsztein (Brazil); forty-eighth and forty-ninth sessions: L.-E. Holm (Sweden), J. Lipsztein (Brazil) and Y. Sasaki (Japan); and fiftieth session: J. Lipsztein (Brazil), Y. Sasaki (Japan) and R. Chatterjee (Canada). The names of members of national delegations who attended the forty-fourth to fiftieth sessions of the Committee as members of national delegations are listed in the appendix to the present report.

3. In approving the present report, the Committee applied its scientific judgement to the material it reviewed and took care to maintain an independent and neutral position in reaching its conclusions. Following established practice, only the main text of the report is submitted to the General Assembly.

4. The Committee wishes to acknowledge the assistance of the consultant, K. Sankaranarayanan, in the preparation of the scientific annex and the advice of the international experts, S. Abrahamson, J. F. Crow, C. Deniston, U. H. Elhing, V. A. McKusick, W. R. Lee, M. F. Lyon, K. G. Lüning, W. J. Schull and R. C. Woodruff, whose independent review was sought by the Committee in its deliberations.

5. The sessions of the Committee held during the period under review were attended by observers from the World Health Organization, the International Atomic Energy Agency, the International Commission on Radiological Protection and the International Commission on Radiation Units and Measurements. The Committee wishes to acknowledge their contributions to the discussions.

6. Radiation exposure has never been demonstrated to cause hereditary effects in human populations. The absence of observable effects in children of survivors of the atomic bombings in Japan, one of the largest study populations, indicates that moderate acute radiation exposures of even a relatively large human population must have little impact. However, experimental studies in plants and animals have

clearly demonstrated that radiation can induce hereditary effects. Humans are unlikely to be an exception in that regard.

7. The Committee has concluded that a sounder basis now exists for estimating the hereditary risks of radiation exposure. Advances in molecular genetics are contributing to improved understanding of the structural and functional changes in genes that underlie hereditary diseases. Gains have also been made in evaluating the risk of multifactorial diseases such as coronary heart disease, diabetes and essential hypertension. Those diseases affect a large proportion of the population, occur throughout life, have varying severity and are affected by both genetic and environmental factors.

8. The Committee uses the doubling-dose method, which is based on equilibrium theory, for hereditary risk estimation. The doubling dose is the amount of radiation required to produce the same number of mutations as occur spontaneously in one generation of the population. The reciprocal of the doubling dose is the relative mutation risk per unit dose. A high doubling dose implies a low relative mutation risk, and vice versa. The risk due to radiation is quantified as the number of additional cases of genetic disease, over and above the baseline incidence, expected for a given radiation exposure. In the present report, the doubling dose has been estimated using spontaneous mutation rates of human genes and radiation-induced mutation rates of mouse genes, because there are no data on radiation-induced mutations in humans. The Committee now estimates the doubling dose to be of the order of one gray for low-dose, sparsely ionizing radiation. This is essentially the same as in earlier reports of the Committee, but supported by more data.

9. For a population exposed to radiation in one generation only, the risks to the progeny of the first post-radiation generation are estimated to be 3,000 to 4,700 cases per gray per one million progeny; this constitutes 0.4 to 0.6 per cent of the baseline frequency of those disorders in the human population.

10. At its fiftieth session, held in Vienna from 23 to 27 April 2001, the Committee decided on its new programme of work. The Committee will gather new data on radiation exposures from natural, man-made and occupational sources; extend its evaluation of medical exposures, especially in relation to new diagnostic procedures that can result in high doses; perform a comprehensive assessment of radon in homes and workplaces; and examine the effects of radiation on the environment as part of a study on radioecology. The Committee also plans to use the cellular and molecular concepts of its 2000 report to address radiation effects at the level of tissues and organs; examine the potential consequences for development of cancer risk from radiation of newly identified cellular responses to radiation; continue to perform epidemiological evaluation of cancer and additionally of diseases other than cancer that may be increased by radiation; and continue its studies on the radiological health effects from the Chernobyl accident. Those studies are expected to be completed and published in 2005.

*Notes*

[1] The United Nations Scientific Committee on the Effects of Atomic Radiation was established by the General Assembly at its tenth session, in 1955. Its terms of reference are set out in resolution 913 (X) of 3 December 1955. The Committee was originally composed of the following Member States: Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, Egypt, France, India, Japan, Mexico, Sweden, Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland and United States of America. The membership of the Committee was subsequently enlarged by the Assembly in its resolution 3154 C (XXVIII) of 14 December 1973 to include the Federal Republic of Germany, Indonesia, Peru, Poland and the Sudan. By its resolution 41/62 B of 3 December 1986, the Assembly increased the membership of the Committee to a maximum of 21 members and invited China to become a member.

[2] For the previous substantive reports of the United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly, see *Official Records of the General Assembly, Thirteenth Session, Supplement No. 17* (A/3838); ibid., *Seventeenth Session, Supplement No. 16* (A/5216); ibid., *Nineteenth Session, Supplement No. 14* (A/5814); ibid., *Twenty-first Session, Supplement No. 14* (A/6314 and Corr.1); ibid., *Twenty-fourth Session, Supplement No. 13* (A/7613 and Corr.1); ibid., *Twenty-seventh Session, Supplement No. 25* (A/8725 and Corr.1); ibid., *Thirty-second Session, Supplement No. 40* (A/32/40); ibid., *Thirty-seventh Session, Supplement No. 45* (A/37/45); ibid., *Forty-first Session, Supplement No. 16* (A/41/16); ibid., *Forty-third Session, Supplement No. 45* (A/43/45), ibid., *Forty-eighth Session, Supplement No. 46* (A/48/46); ibid., *Forty-ninth Session, Supplement No. 46* (A/49/46); ibid., *Fifty-first Session, Supplement No. 46* (A/51/46); ibid., *Fifty-second Session, Supplement No. 46* (A/52/46); ibid., *Fifty-third Session, Supplement No. 46* (A/53/46); ibid., *Fifty-fourth Session, Supplement No. 46* (A/54/46); and ibid., *Fifty-fifth session, Supplement No. 46* (A/55/46). These documents are referred to as the 1958, 1962, 1964, 1966, 1969, 1972, 1977, 1982, 1986, 1988, 1993, 1994, 1996, 1997, 1998, 1999 and 2000 reports, respectively. The 1972 report, with scientific annexes, was published as *Ionizing Radiation: Levels and Effects, Volume I: Levels* and *Volume II: Effects* (United Nations publication, Sales Nos. E.72.IX.17 and 18). The 1977 report, with scientific annexes, was published as *Sources and Effects of Ionizing Radiation* (United Nations publication, Sales No. E.77.IX.1). The 1982 report, with scientific annexes, was published as *Ionizing Radiation: Sources and Biological Effects* (United Nations publication, Sales No. E.82.IX.8). The 1986 report, with scientific annexes, was published as *Genetic and Somatic Effects of Ionizing Radiation* (United Nations publication, Sales No. E.86.IX.9). The 1988 report, with scientific annexes, was published as *Sources, Effects and Risks of Ionizing Radiation* (United Nations publication, Sales No. E.88.IX.7). The 1993, 1994 and 1996 reports, with scientific annexes, were published as *Sources and Effects of Ionizing Radiation* (United Nations publication, Sales Nos. E.94.IX.2, E.94.IX.11 and E.96.IX.3, respectively). The 2000 report, with scientific annexes, was published as *Sources and Effects of Ionizing Radiation, Volume I: Sources* and *Volume II: Effects* (United Nations publication, Sales Nos. E.00.IX.3 and 4).

# Appendix I

## Members of national delegations attending the forty-fourth to fiftieth sessions

| | |
|---|---|
| Argentina | D. Beninson (Representative), E. d'Amato, D. Cancio, P. Gisone |
| Australia | P. A. Burns (Representative), K. H. Lokan (Representative), J. Loy, D. I. Macnab, S. Solomon |
| Belgium | J. R. Maisin (Representative), A. Debauche, R. Kirchmann, H. P. Leenhouts, J. Lembrechts, K. Sankaranarayanan, P. Smeesters, J. van Dam, H. Vanmarcke, A. Wambersie |
| Brazil | J. L. Lipsztein (Representative), D. R. Melo, A. T. Ramalho, E. R. Rochedo |
| Canada | R. M. Chatterjee (Representative), D. B. Chambers, R. J. Cornett, N. E. Gentner (Representative), R. V. Osborne (Representative), S. Vlahovich (Representative) |
| China | Z. Pan (Representative), N. Gu, F. He, Q. He, J. Ma, B. Mao, K. Li, P. Liu, Y. Song, X. Su, Z. Tao, K. Wei, B. Xiu, G. Yang, H. Yang, J. Yu, L. Zhang, Y. Zhao, J. Zhou, B. Zhu |
| Egypt | A. M. El-Naggar (Representative), F. Hammad (Representative), M. A. Gomaa |
| France | J. F. Lacronique (Representative), A. Aurengo, M. Bourguignon, A. Flüry-Hérard, J. Lallemand, C. Luccioni, R. Masse (Representative), J. Piéchowski, A. Rannou, M. Tirmarche |
| Germany | W. Burkart (Representative), U. Ehling, W. Jacobi, T. Jung, A. Kaul (Representative), A. Kellerer, J. Kiefer, G. Kirchner, W. Köhnlein, C. Reiners, F. E. Stieve, C. Streffer (Representative), W. Weiss |
| India | K. B. Sainis (Representative), P. C. Kesavan (Representative) |
| Indonesia | K. Wiharto (Representative), T. Suprihadi, S. Zahir |
| Japan | Y. Sasaki (Representative), T. Asano, M. Doi, H. Iizuka, T. Isoyama, S. Kumazawa, S. Mizushita, K. Morita, Y. Muramatsu, N. Nakagawa, J. Onodera, K. Sato, T. Sato, Y. Taguchi, K. Tatsumi, M. Yoshizawa |
| Mexico | J. R. Ortiz-Magaña (Representative), E. Araico Salazar (Representative) |
| Peru | L. V. Pinillos-Ashton (Representative) |
| Poland | Z. Jaworowski (Representative), M. Waligórski, L. Dobrzynski |
| Russian Federation | L. A. Ilyin (Representative), R. M. Alexakhin, L. A. Buldakov, N. P. Garnyk, K. I. Gordeev, A. K. Guskowa, V. K. Ivanov, J. B. Kholina, I. S. Koshkin, I. I. Kryshev, I. I. Kulyeshov, B. K. Lobach, O. A. Pavlovski, T. S. Povetnikova, M. N. Savkin, V. A. Shevchenko |

| | |
|---|---|
| Slovakia | D. Viktory (Representative), I. Bučina, P. Gaál, V. Klener, E. Kunz |
| Sudan | K.E.H. Mohamed (Representative), O. I. Elamin (Representative) |
| Sweden | L. E. Holm (Representative), G. Bengtsson (Representative), U. Bäverstam, L. Moberg, W. Leitz, J. O. Snihs |
| United Kingdom of Great Britain and Northern Ireland | R. H. Clarke (Representative), H. J. Dunster, V. Beral, F. A. Fry, J. W. Stather |
| United States of America | F. A. Mettler (Representative), L. Anspaugh, J. D. Boice Jr., N. H. Harley, E. V. Holahan, C. B. Meinhold, R. J. Preston, P. B. Selby, W. K. Sinclair |

**Secretariat of the United Nations Scientific Committee on the Effects of Atomic Radiation**

B. G. Bennett

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